

Lissodelphis borealis. By Thomas A. Jefferson and Michael W. Newcomer

Published 23 April 1993 by The American Society of Mammalogists

Lissodelphis Gloger, 1841

Tursio Wagler, 1830:34. Type species *Delphinus peronii* Lacépède.
Lissodelphis Gloger, 1841:169. Type species *Delphinus peronii* Lacépède.

Leucorhamphus Lilljeborg, 1861:5. Type species *Delphinus peronii* Lacépède.

CONTEXT AND CONTENT. Order Cetacea, Suborder Odontoceti, Family Delphinidae. Some authors place the genus in a subfamily, Lissodelphininae (Fraser and Purves, 1960), although this is not universally agreed-upon. The genus contains two living species: *Lissodelphis borealis* (northern right whale dolphin) and *L. peronii* (southern right whale dolphin).

Lissodelphis borealis (Peale, 1848)

Northern Right Whale Dolphin

Delphinapterus borealis Peale, 1848:35. Type locality 46°07'N, 134°05'W (800 km off Astoria, Oregon).

Delphinus borealis Cassin, 1858:30. Renaming of *Delphinapterus borealis* Peale.

Leucorhamphus borealis Dall, 1874:296. Renaming of *Delphinapterus borealis* Peale.

Tursio borealis True, 1889:80. Renaming of *Delphinapterus borealis* Peale.

CONTEXT AND CONTENT. *Lissodelphis borealis* currently contains no subspecies.

DIAGNOSIS. The northern right whale dolphin (*Lissodelphis borealis*) is the only delphinid in the North Pacific without a dorsal fin. This species is extremely slender, and has a mostly black color pattern with a well-demarcated white ventral patch (Fig. 1). *Lissodelphis peronii* shares these features, but is found only in the Southern Hemisphere, and has a more extensive white ventrolateral patch, and white flippers (Fraser, 1955). Skeletal differences between the two species have not been adequately studied.

The skull of the northern right whale dolphin (Fig. 2) is slender, with a condylobasal length of 420 to 474 cm (about 2.17 times the width) (Jefferson et al., in press; Nishiwaki, 1972; Tomilin, 1957). The rostrum is also long and slender, with a length/breadth ratio of 2.18 (Nishiwaki, 1972). The mandibular symphysis is relatively short (Nishiwaki, 1972; Tomilin, 1957). The tympanoperiotic bones (Fig. 3) resemble those of dolphins of the genus *Stenella* (spotted, spinner, and striped dolphins), although the ventral keels of the tympanic bullae are shorter in *Lissodelphis* (Kasuya, 1973). There are 37 to 52 small pointed teeth in each row of the upper jaw, and 42 to 54 in each row of the lower (Jefferson et al., in press; Okada and Hanaoka, 1940; Tobayama et al., 1969).

Northern right whale dolphins have 88 to 92 vertebrae, and the formula is 7 cervical, 14 to 17 thoracic, 29 to 33 lumbar, and 35 to 40 caudal (Tobayama et al., 1969). The first two cervicals are fused (Nishiwaki, 1972). There is a total of 14 to 17 pairs of ribs, of which 4 to 6 pairs are double-headed (Tobayama et al., 1969). The chevron bones number 25 to 30 (Tobayama et al., 1969). The phalangeal formula is I 1 to 2; II 7 to 8; III 5 to 6; IV 3; and V 2 to 3 (Tobayama et al., 1969). The osteology of nine Japanese specimens has been described in detail by Okada and Hanaoka (1940).

GENERAL CHARACTERS. Maximum known length for the northern right whale dolphin is 3.1 m, and maximum known weight is 113 kg (Leatherwood and Walker, 1979). Males attain greater maximum lengths and weights than females. Perhaps the slenderest of all dolphins, right whale dolphins have no hint of a dorsal fin or dorsal ridge, a fact which may make them appear even more slim than they are (Fig. 1). They have a short, well-defined beak, with a straight mouthline. The flippers are small and curved, with pointed tips. The flukes are also small, with a concave trailing edge and a deep median notch.

The color pattern is predominantly black, with a white lanceolate band on the belly that widens to cover the entire distance between the flippers (Fig. 1). There is also a small white patch just behind the tip of the lower jaw. The flukes are edged with crescent-

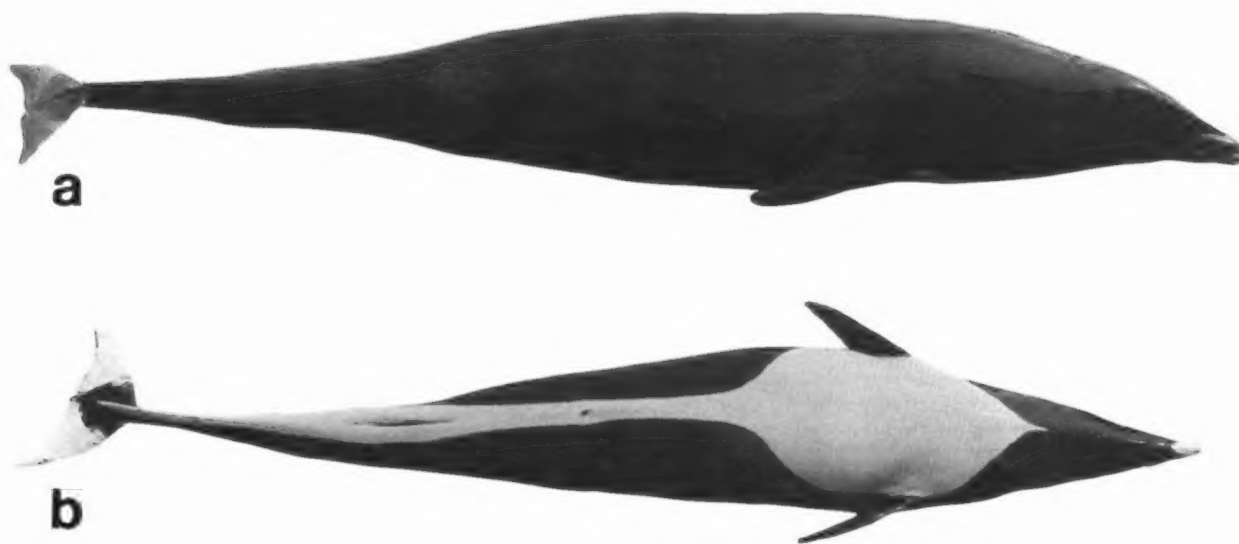


FIG. 1. Lateral (a) and ventral (b) views of an adult northern right whale dolphin (225 cm female taken in a central North Pacific squid driftnet).

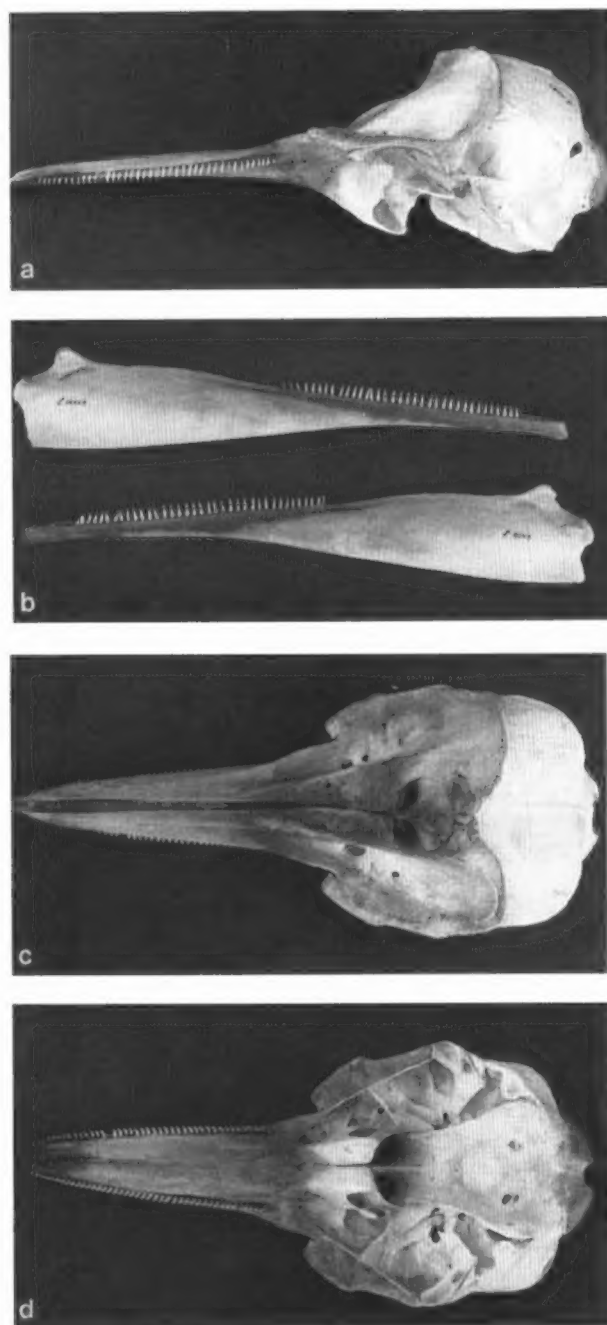


FIG. 2. Skull of the northern right whale dolphin (California Academy of Sciences 16664): lateral view of cranium (a), lateral view of mandibles (b), dorsal view of cranium (c), and ventral view of cranium (d).

shaped patches of white on the ventral surface, and light gray on the dorsal surface.

Some northern right whale dolphins possess an uncommon color pattern, which Black and Jefferson (in press) have termed "swirled." There have been sightings and specimen records of this type on both sides of the Pacific (Black and Jefferson, in press; Leatherwood and Walker, 1979; Ogawa, 1937; Tobayama et al., 1969).

Right whale dolphins are born with a muted color pattern of gray tones instead of black and white (Jefferson et al., in press; Leatherwood and Walker, 1979). Young calves often have a brownish to cream tone as well. They appear to attain adult coloration by the end of their first year.

With the exception of a larger maximum size in males, there is no obvious sexual dimorphism in northern right whale dolphins. However, the width of the white ventral band differs in the urogenital

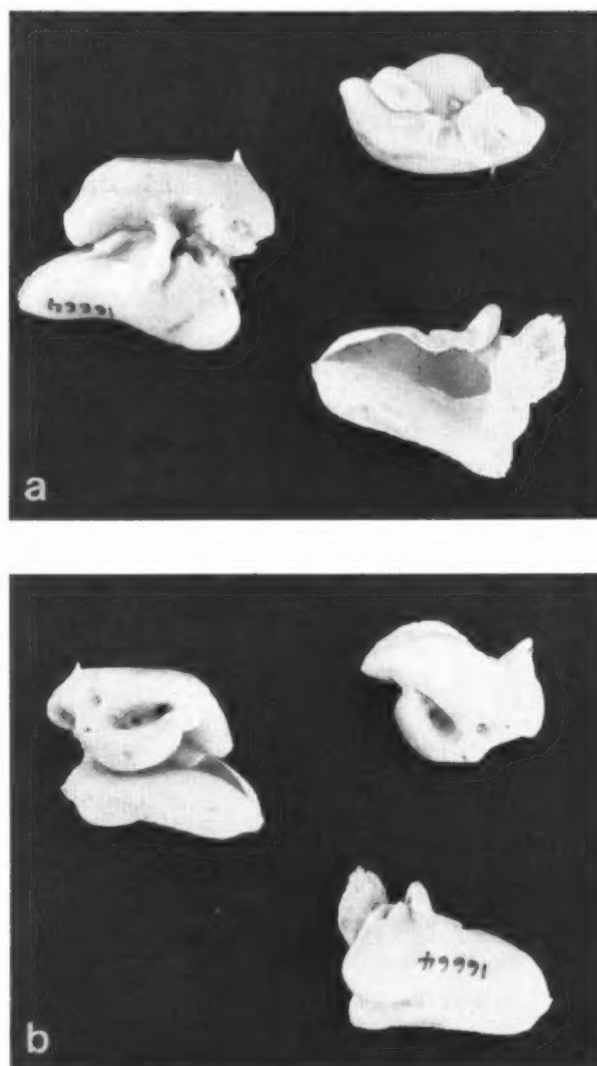


FIG. 3. Tympanoperiotic bones of the northern right whale dolphin (CAS 16664). Top photo (a): ventral view of left tympanoperiotic articulated (left), ventral view of right periotic (upper right), and dorsal view of right tympanic bulla (lower right). Bottom photo (b): dorsal view of left tympanoperiotic articulated (left), dorsal view of right periotic (upper right), and ventral view of right tympanic bulla (lower right).

areas of males and females; it is wider in females (Leatherwood and Walker, 1979).

DISTRIBUTION. Northern right whale dolphins are found only in the North Pacific Ocean (Fig. 4). In the western Pacific, they are distributed from Cape Nojima, Japan (35°N) in the south to Paramushir Island, U.S.S.R. (51°N) in the north (Nishiwaki, 1967; Sleptsov, 1961). In the central Pacific, catches in driftnets indicate that they occur at least as far south as 35°N (Bjørge et al., 1991). Most eastern Pacific records are confined to the area between 29°N (northern Baja California, Mexico) and 51°N (northern Vancouver Island, British Columbia, Canada), with movements south of 30°N apparently limited to periods of anomalously cold water temperatures (Leatherwood and Walker, 1979; Leatherwood et al., 1982). There are a few sightings as far north as 53°N (just south of the western Aleutian Islands) and 59°N (Gulf of Alaska), but these are considered extralimital (Kajimura and Loughlin, 1988).

Scammon's (1874) report of this species as far north as the Bering Sea, although repeated by many authors, has not been confirmed by any additional records since that time. Okada and Hanaoka (1940) indicated that northern right whale dolphins are also found in the "northern sea of Japan." They apparently meant the Pacific coast of Japan, not the Sea of Japan proper, since there are no sighting or specimen records in the Sea of Japan.

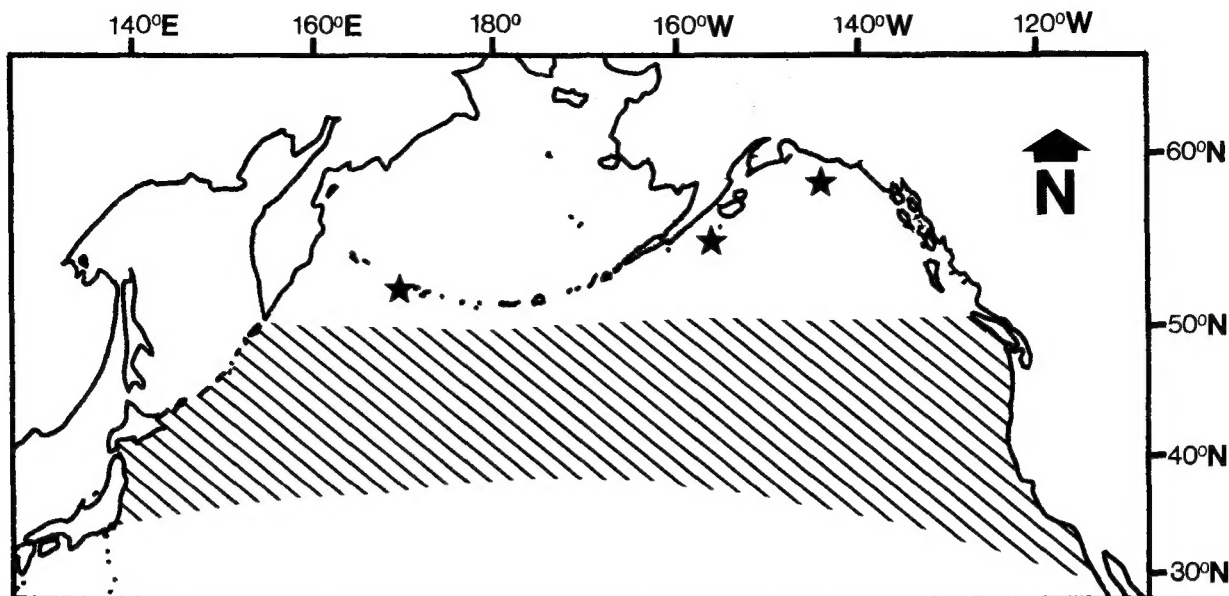


FIG. 4. Distribution of the northern right whale dolphin in the North Pacific Ocean. Shading indicates normal distribution and stars show extralimital sightings of Kajimura and Loughlin (1988).

FORM AND FUNCTION. Very little work has been done on the anatomy and physiology of northern right whale dolphins. All aspects of the skeleton, including the skull, are light and weakly built (Okada and Hanaoka, 1940). The skull, as in many odontocetes, is noticeably asymmetrical. The median dorsal line and nares are offset to the left (Okada and Hanaoka, 1940).

The blubber layer has a depth of approximately 1–2 cm (Leatherwood and Walker, 1979; Scheffer and Slipp, 1948). Litchfield et al. (1975) described the composition of fats in the jaw and melon, which differ significantly from those of the blubber. These specialized fats are presumed to play a role in transmission of sound during echolocation. Morejohn (1979) was not able to find the external auditory meatus in some specimens of this species.

The electrophoretic mobility of the hemoglobin was studied by Sharp (1975), who found much in common with the Pacific white-sided dolphin (*Lagenorhynchus obliquidens*).

The anatomy of the nasal sacs and facial musculature resembles the general pattern of other delphinids (Mead, 1975; Schenckan, 1973). The premaxillary sacs are relatively large.

ONTOGENY AND REPRODUCTION. Almost nothing is known of reproduction in the northern right whale dolphin. Leatherwood et al. (1982) estimated length at birth to be about 80 to 100 cm, although the smallest known individual was 97 cm long (Jefferson et al., in press). Most newborn have been observed in winter (Dohl et al., 1983) or early spring (Leatherwood et al., 1982).

Length at sexual maturity is known from a sample of only 23 eastern Pacific specimens of known length with reproductive data (Harrison et al., 1972; Leatherwood and Walker, 1979; Sullivan and Houck, 1979; Walker, 1975; Wick, 1969). Males apparently become mature between 212 and 220 cm, and females at about 200 cm.

Miyazaki (1986) presented data from 21 females from the western North Pacific that suggest maturation at lengths of between 206 and 212 cm. It is unknown if the difference from the eastern Pacific data reflects real geographical variation or is simply an artifact.

ECOLOGY. Northern right whale dolphins are known to associate with at least 14 other species of marine mammals, including eight species of small cetaceans, five species of large whales, and one species of pinniped (see review in Jefferson et al., in press). Their most common associate is the Pacific white-sided dolphin, with which they share a common range and intermix freely (Leatherwood, 1974; Leatherwood and Walker, 1979; Leatherwood et al., 1982). Other species that are commonly found with them are Risso's dolphins (*Grampus griseus*) and pilot whales (*Globicephala* sp.). There is no information on predation, but killer whales (*Orcinus orca*), and

possibly large sharks, can be expected to be at least occasional predators.

Northern right whale dolphins appear to feed primarily on market squid (*Loligo opalescens*) and lanternfish (myctophids) (Leatherwood and Walker, 1979). Other prey species include squids of the families Gonatidae, Enoploteuthidae, Histioteuthidae, and Onychoteuthidae; Pacific hake (*Merluccius productus*); saury (*Cololabis saira*); and epi- and mesopelagic fishes of the following families: Centrolophidae, Melamphidae, Bathylagidae, and Paralepididae (Beach et al., 1985; Clarke, 1986; Fitch and Brownell, 1968; Leatherwood and Walker, 1979; Sullivan and Houck, 1979).

Unexpected items, such as marine plant material, a bee, bird feathers, and plastic debris, were reported from stomachs of two animals from southern California (Walker and Coe, 1990). Both animals were stranded and diseased from parasitic infestation; these unusual items probably thus do not reflect normal feeding behavior.

Internal parasites of northern right whale dolphins include *Nasitrema* sp. in the air sinuses and brain, *Crassicauda* sp. in the air sinuses and inner ear, *Anisakis simplex* in the stomach, *Phyllobothrium* sp. in the blubber, *Sarcosporidia* sp. in the muscle, and *Monorygma grimaldii* in the peritoneum (Cowan et al., 1986; Dailey and Brownell, 1972; Dailey and Walker, 1978; Neiland et al., 1970; Testa and Dailey, 1977; Walker, 1975). This species has also been known to be host to the barnacle *Xenobalanus* sp. and the ectoparasitic copepod *Penella* sp. (Dailey and Walker, 1978).

The habitat of this species appears to be relatively deep continental shelf and offshore waters with temperatures of 8–24°C (Björge et al., 1991). They are seen nearshore only where submarine canyons or other features bring deep water near the coast.

Leatherwood and Walker (1979) gave a preliminary population estimate of 17,800 animals off southern California during periods of peak density. Numbers in central California have been estimated to range between 27,000 and 61,500 (Dohl et al., 1983). In the eastern Pacific, right whale dolphins appear to be most common from southern to central California, with lower density in the more northern parts of their range (Leatherwood and Walker, 1979; Leatherwood et al., 1982). Preliminary mean estimates of abundance in the North Pacific range from 247,000 to 535,000 (see Mangel, in press).

Extensive migrations are not known, but there do seem to be inshore shifts in abundance for winter and spring off California, and these correspond with peak densities of market squid inshore (Leatherwood and Walker, 1979). There are inshore and southern shifts in abundance in cold water months (June–October) throughout the range (Björge et al., 1991). In general, inshore and southern shifts in late fall, and offshore and northern shifts in spring may be limited by an associated water temperature range of 8 to 19°C (Leatherwood and Walker, 1979; Leatherwood et al., 1982). Kasuya (1971) also

reported right whale dolphins off northern Honshu, Japan, only in relatively cold-water non-summer months.

Strandings are not common, but generally a few occur each year throughout the species' range (Leatherwood and Walker, 1979). An exceptional year was 1981 when, for unknown reasons, at least 23 specimens stranded on southern and central California beaches alone (Leatherwood et al., 1987). All known strandings have been of an individual nature, and these are mostly associated with pathological conditions caused by, or aggravated by, parasites such as the air sinus fluke *Nasitrema* sp. (Cowan et al., 1986; Dailey, 1985; Dailey and Walker, 1978; Ridgway and Dailey, 1972; Walker, 1975). Heart scars, pneumonitis, pulmonary edema and other lung pathology, gastric ulceration, and brain lesions, many of these associated with parasites, were reported from stranded northern right whale dolphins (Cowan et al., 1986).

Northern right whale dolphins are sometimes taken in Japanese harpoon fisheries and Japanese and Soviet purse-seine fisheries, but there is no fishery in which this dolphin has been the main target (Klumov, 1959; Miyazaki, 1983; Ohsumi, 1972; Wilke et al., 1953).

Small numbers of northern right whale dolphins appear to be taken incidentally in Japanese salmon gillnet fisheries (International Whaling Commission, 1983), and some are known to be taken in American driftnets set for sharks and swordfish. A short-lived Canadian experimental squid driftnet fishery took 13 right whale dolphins in 1986 and 1987 (Jamieson and Heritage, 1988; Baird and Stacey, 1991).

This species is the major marine mammal taken as by-catch in the extensive North Pacific squid driftnet fishery that operates out of Japan, Korea, and Taiwan. The fishery started in 1978, with a take of about 300–400 northern right whale dolphins; between 1985 and 1990, the take was estimated at about 15,000–20,000 dolphins per year (Bjørge et al., 1991; Mangel, in press). Although there are only preliminary estimates of abundance, and stock structure of central North Pacific right whale dolphins is unknown, there is evidence to indicate that this fishery has depleted the population to 24–73% of its pre-exploitation size (see Mangel, in press). A United Nations moratorium on high seas driftnets may result in the closure of this fishery.

There have been some attempts to live-capture northern right whale dolphins for display and research in United States waters (Reeves and Leatherwood, 1984; Walker, 1975; Wood, 1973). One specimen lived for 15 months in captivity, but most others have died within a few weeks (Walker, 1975).

There is no published information on levels of environmental contaminants in northern right whale dolphins.

BEHAVIOR. Northern right whale dolphins are generally seen in large groups, ranging in size from single animals to 2,000 individuals. Mean herd sizes are 110 for the eastern Pacific (Leatherwood and Walker, 1979) and over 200 for the western Pacific (Nishiwaki, 1972). Most herds can be characterized as having one of four configurations: tightly packed herds with no subgroups, herds with scattered subgroups of various sizes, V-shaped herds, and "chorus lines" (Leatherwood and Walker, 1979). The first type of group was often observed when the animals were disturbed by aircraft (Leatherwood and Walker, 1979).

When moving slowly, northern right whale dolphins create little surface disturbance as they roll at the surface. In these instances, they are difficult to detect, except at close range in calm seas. When swimming at speed, they either surface to breathe rapidly, exposing little of themselves; or make low angle leaps covering up to several body lengths, in which great splashes are created (Leatherwood and Walker, 1979). Dive times of up to 6.25 minutes have been recorded (Leatherwood and Walker, 1979). These are fast swimmers, capable of speeds of over 40 km/h (Leatherwood and Reeves, 1983).

Right whale dolphins are capable bowriders, especially when in the company of other species of dolphins, although they may at times avoid vessels. Aerial activity is common in this species, with fluke slaps and breaches (landing on the belly and sides) seen in both slow and fast moving schools.

Cassin (1858) and Peale (1848) reported epimeletic behavior, but there has been some question as to whether it really involved this species. Nothing is known of the reproductive and mating behavior of the northern right whale dolphin.

The sounds of northern right whale dolphins have not been described in detail; however, Fish and Turl (1976) and Leatherwood

and Walker (1979) reported high repetition rate clicks and a few whistles from some recordings at sea.

GENETICS. Duffield (1977) described the karyotype of the northern right whale dolphin.

REMARKS. There has been some speculation that northern and southern right whale dolphins represent subspecies of *L. peronii* (Honacki et al., 1982; Rice, 1977), but nearly all recent authors accept them as separate species. However, this conclusion must be considered tentative until a large sample of both types becomes available for study.

Other common names include Pacific right whale porpoise, *delphin liso del norte* (Spanish), *severnnyi kitovidyi del'fin* (Russian), *kita semi iruka* (Japanese), and *dauphin à dos lisse boréal* (French).

Thanks to S. Baldrige and S. Ohsumi for assistance in obtaining references, and to B. E. Curry and an anonymous referee for reviewing the manuscript. This represents Contribution No. 24 of the Marine Mammal Research Program, Texas A&M University.

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Editors for this account were TROY L. BEST and KARL F. KOOPMAN. Managing editor was CRAIG S. HOOD.

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